REMARKS

Applicant thanks the Examiner for the careful review of this application. Claims 82-92 were previously canceled without prejudice and claims 9, 37, 42, 50, 94, 98 and 109 were also canceled without prejudice in this response. The specification was amended to correct a clerical error and to add support for originally filed claims. Claims 1-2, 10-12, 32, 40, 43-46 and 51 were amended to clarify the claimed embodiments. New claims 116-117 were entered for consideration. No new matter was added. Therefore, claims 1-8, 10-36, 38-41, 43-49, 51-81, 93, 95-97, 99-108 and 110-117 remain pending in this application.

DOUBLE PATENTING

Claims 1, 2, 32, 37-39, 73, 78, 81, 93, 94, 98-100, 105, 106, 109 were provisionally rejected under the judicially created doctrine of non-statutory double patenting in view of co-pending U.S. Patent Application no. 10/627,416. Applicant acknowledges these rejections and respectfully traverses their propriety. Applicant respectfully requests for these rejections to be held in abeyance until this application is otherwise in condition for allowance.

FIGURES

As requested, Applicant is supplying replacement figures. Additionally, Fig. 5 was objected to for not including reference numeral 110 or the line "B-B". Replacement Fig. 5 includes both items. Applicant notes that original Fig. 5 does contain the line B-B. Withdrawal of the figure objection is respectfully requested.

SPECIFICATION OBJECTIONS

The specification was objected to due to a clerical error. Applicant has corrected the clerical error by way of the preceding amendment. Withdrawal of the specification objection is respectfully requested.

CLAIM OBJECTIONS

Claim 50 was objected to as being a duplicate of claim 47. Applicant has canceled claim 50 and the objection of this claim is now moot.

REJECTIONS UNDER 35 U.S.C. § 112, FIRST PARAGAPH

Claims 11, 13-14, 18-21, 23-24, 29, 42, 44, 46-47, 50-55, 58-59 and 67-68 were rejected under 35 U.S.C. § 112, first paragraph as not being enabled for the claimed processing conditions. Applicant respectfully traverses for the following reasons.

By way of the preceding amendment, Applicant has added enablement to the specification via new paragraph **[0054.5]**. Applicant respectfully directs the Examiner's attention to section III of MPEP 2163.06 that is reproduced below for the Examiner's convenience:

**"III. CLAIMED SUBJECT MATTER NOT DISCLOSED IN REMAINDER OF SPECIFICATION
The claims as filed in the original specification are part of the disclosure and therefore, if an application as originally filed contains a claim disclosing material not disclosed in the remainder of the specification, the applicant may amend the specification to include the claimed subject matter. *In re Benno*, 768 F.2d 1340, 226 USPQ 683 (Fed. Cir. 1985)."**

Since the specification now enables the rejected claims, Applicant respectfully requests the withdrawal of claims 11, 13-14, 18-21, 23-24, 29, 42, 44, 46-47, 50-55, 58-59 and 67-68.

REJECTIONS UNDER 35 U.S.C. § 102(b)

Claims 1, 30, 31, 93, 98, 103-105, 109 and 114 were rejected under 35 U.S.C. § 102(b) as being anticipated by Datta (U.S. Patent No. 5,152,878). Applicant respectfully traverses for the following reasons.

Datta apparently discloses an electrochemical method for selective removal of metallic residual stains which form on molybdenum masks during processing of integrated circuits. The method utilizes an electrolytic cell which has, as it's elements, the mask as the anode, an electrolyte of phosphoric acid and glycerol, a cathode and a power supply. That cell is used to electrochemically clean the mask, forming a surface film and electrolyte layer on the mask which includes the metallic residual stain. To remove the surface film and electrolyte layer and, concurrently, the metallic residual stain, the mask is rinsed with water. It is then dried.

Aspects of the claimed embodiments are directed to methods for cleaning molybdenum masks by using an aqueous cleaning solution that includes at least 5% but less than 50% hydrochloric acid by weight. Advantageously, the claimed embodiments allow for a simple process to correctly clean molybdenum masks such that the usable life of those masks is greatly extended. One example process utilizing the hydrochloric solution is repeated below:

> **"In one embodiment, an etching solution of hydrochloric acid (HCl) was used. Various concentrations of hydrochloric acid, ranging from approximately 10% to approximately 37% by weight were tested. It was found that a concentration of approximately 37% was particularly useful with agitation. Etching with the 37% concentration and an agitation power of about 25 W/gallon of liquid for about 20 minutes quickly removed**

materials deposited on the mask with relatively minimal damage to the mask (within the +/- 0.1 µm specification). Damage to the masks was inspected on an SEM (scanning electron microscope)."
- Applicant's specification, page 15, lines 9-16.

In marked contrast, Datta teaches a multi-step cleaning process that utilizes various, differing cleaning solutions. The disclosed cleaning process is shown here:

> The following process steps typically are applied to chemically remove the metal stack from the molybdenum mask:
> 1. a solder stripper removes PbSn;
> 2. HCl removes the underlying Cr, Cu, and Au by undercut;
> 3. Alkaline $KMnO_4$;
> 4. HCl;
> 5. KI/I;
> 6. HCl;
> 7. Domestic and DI water rinses;
> 8. Freon; and
> 9. Oven dry.

- Datta, column 2, lines 45-57.

While the above-listed process does list individual steps that utilize hydrochloric acid alone, it does not teach the use of an aqueous solution of hydrochloric acid by itself as the only cleaning solution / cleaning step. Furthermore, Datta also comments negatively on this process as it tends to attack the base molybdenum of the mask. As a result, it is rather unlikely that one looking to provide a cleaning process that does not render a mask unusable would utilize Datta's disclosure.

Datta additionally discloses using a singe chemical cleaning step of undiluted hydrochloric acid and hydrochloric acid in combination with sulfuric and nitric acids such as the ones described as follows:

Several chemical etchants were selected and studied based on their ability to remove steel and stainless steel layers. Moreover, the following solution is known to clean the surface of a molybdenum mask: 150 ml./liter concentrated nitric acid+300 ml./liter concentrated hydrochloric acid+150 ml./liter concentrated sulphuric acid+400 ml./liter water. See H. S. Hoffman, *Molybdenum Cleaning solution*, IBM Technical Disclosure Bulletin, vol. 3, no. 5 (Oct. 1960). Thus, hydrochloric acid and mixtures of hydrochloric and nitric acids of different proportions were used as chemical cleaning solvents. Table I summarizes the results.

TABLE I

CHEMICAL CLEANING OF MOLYBDENUM MASK RESIDUALS

Solution	Cleaning time (min)	Delta d (micron)	Remarks
HCl (without dilution)	35	0.4	not cleaned
0.1 HNO₃ + 0.9 HCl	4	5.4	clean
0.1 HNO₃ + 0.9 HCl	7	14.0	clean
0.5 HNO₃ + 0.5 HCl	7	14.1	clean
0.02 HNO₃ + 0.98 HCl	25	5.5	clean
0.05 HNO₃ + 0.95 HCl	7	11.7	clean
0.01 HNO₃ + 0.99 HCl	30	—	no attack
0.02 HNO₃ + 0.98 H₂O	30	—	no attack
0.05 HNO₃ + 0.95 H₂O	30	—	no attack
0.05 HNO₃ + 0.05 HCl + 0.9 H₂O	30	—	no attack

- Datta, column 3, lines 21-46.

However, Datta also characterizes these various combinations as unsatisfactory since the molybdenum on the mask is attacked. Again, those looking to provide a robust mask cleaning process would be dissuaded from using the processes disclosed by Datta.

Additionally, Datta discloses using HCl in combinations of 5% HCl by weight and below and 50% HCl by weight and above. Therefore, Datta does not disclose the claimed range of at least 5% but less than 50% HCl by weight.

In view of the foregoing, Applicant respectfully submits that Datta does not disclose the claimed embodiments. Withdrawal of the rejections of claims 1 and 6-7 is respectfully requested.

REJECTIONS UNDER 35 U.S.C. § 103(a)

Claim 29 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Datta (U.S. Patent No. 5,152,878). Claims 2, 32, 36-37, 40-50, 67-72, 94 and 106 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Datta in view of JP11-290805. Claims 3-28, 33-35, 38-39, 51-66, 73-81, 95-97, 99-102, 107-108, 110-113 and 115 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Datta in view of Furuumi (JP11-290805) and Spring (Metal Cleaning, Reinhold Publishing Corporation, 1963, pages 83-89).

Datta was previously summarized. Furuumi apparently discloses a piece of ultrasonic cleaning equipment having a cleaning tank sized appropriately to accept a metal mask for cleaning. The equipment includes the tank and a cleaning liquid circulating system that further includes a filter for filtering the cleaning liquid as it circulates through the equipment.

Spring apparently discloses a method for generating ultrasonic agitation.

For reasons similar to those as put forth in the previous section, Applicant respectfully submits that Datta in combination with Furuumi and/or Spring also does not disclose the claimed embodiments.

Since Datta, Furuumi and Spring do not provide any disclosure for cleaning metal masks in an aqueous solution of 6-49% hydrochloric acid by weight, they therefore also do not disclose any of the claimed percentages of hydrochloric acid as detailed in claims 10-12, 43-45, 103 and 114-116.

Applicant also respectfully submits that the cited prior art does not disclose cleaning molybdenum masks using a cleaning solution consisting essentially of at least 5% but less than 50% hydrochloric acid by weight as described in new claim 116.

Additionally, the cited references also do not disclose any of the claimed agitation power figures that are contained in claims 23-28 and 58-63.

Furthermore, Datta, Furuumi and Spring all also do not disclose the claimed embodiments of cleaning a mask in a first vessel containing a cleaning solution such that the first container is situated in a second vessel that contains an aqueous solution such as the one depicted in Applicant's Fig. 5:
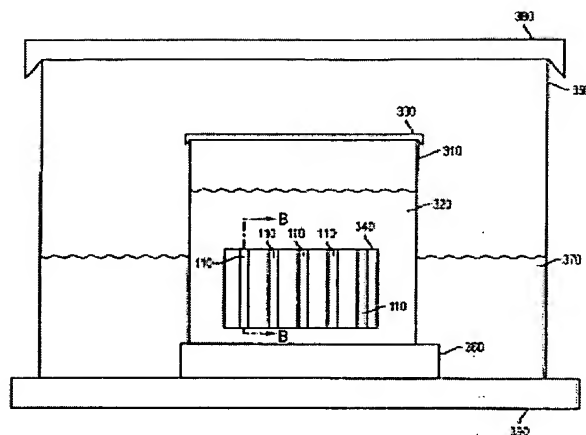
In marked contrast, the cited prior art does not disclose or provide a suggestion to place a first vessel into a second vessel. Both Furuumi and Spring disclose methods for ultrasonically etching/cleaning metals via a <u>single</u> tank system. For example, Furuuma teaches the use of a single tank that recycles the cleaning solution via a filtering system to extend the lifecycle of the solution as follows:
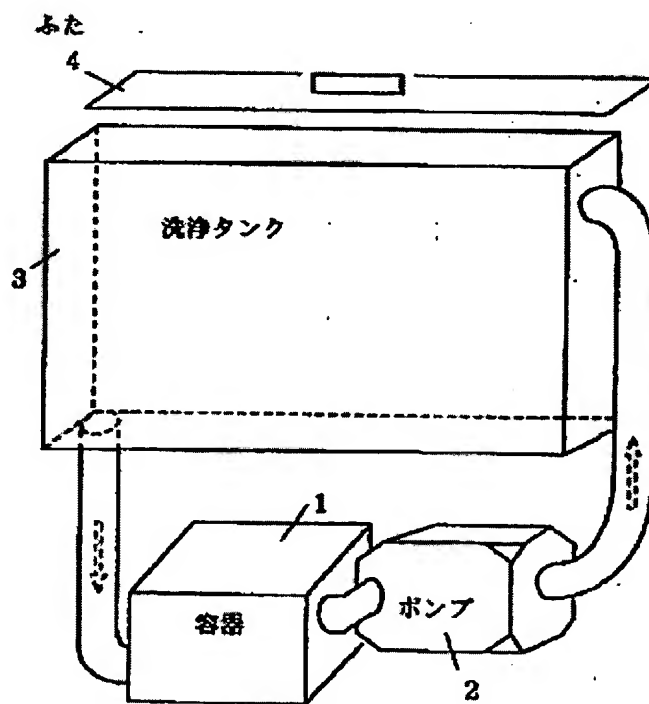
Similarly, Spring also discloses a single tank system as shown below:
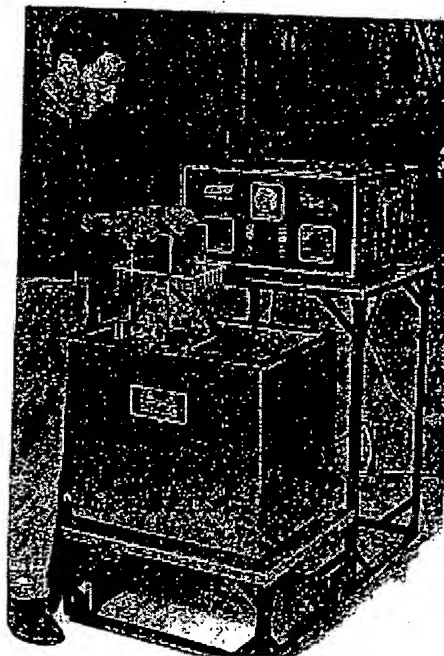
As can be seen from Spring's Fig. 28A, a technician is placing a basket that contains objects to be cleaned into a tank coupled to a transducer. Since the width of the basket is almost as large as the opening on the tank, it is logical to assume that there is not a second tank contained in the first tank. That is, if there was an inner / second tank, the basket would have to be smaller than the opening of the inner tank. Additionally, there is no mention of an inner / second tank in the excerpt from Spring's book that the Examiner provided.

In view of the foregoing, Applicant respectfully submits that the prior art cited by the Examiner does not disclose the claimed embodiments. Withdrawal of the rejections of claims is respectfully requested.
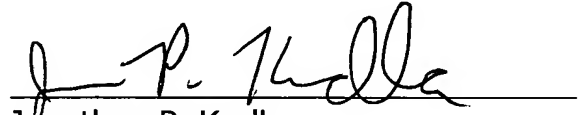
CONCLUSION

Applicant believes that all pending claims are allowable and a Notice of Allowance is respectfully requested. The amendment was made to expedite the prosecution of this application. Applicant respectfully traverses the rejections of the amended claims and reserves the right to re-introduce them and claims of an equivalent scope in a continuation application.

If the Examiner believes that a conference would be of value in expediting the prosecution of this application, he is cordially invited to telephone the undersigned counsel at the number set out below.

Respectfully submitted,
PERKINS COIE LLP

Date: July 18, 2005

Jonathan P. Kudla
Reg. No. 47,724

Customer No. 22918
Perkins Coie LLP
P.O. Box 2168
Menlo Park, CA 94026
Telephone: (650) 838-4300